Analytical and Bioanalytical Chemistry 2005 vol.381 N8, pages 1546-1551

Electrochemical determination of the total antioxidant capacity of human plasma

Ziyatdinova G., Budnikov H., Pogorel'Tzev V.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

Electrochemical reduction of oxygen at a glassy carbon electrode in a 0.05 mol L-1 solution of (C2H5)4NI in dimethylformamide leads to generation of the superoxide anion-radical. This product of reversible one-electron oxygen reduction reacts with antioxidants, a process which is based on protonation of the anion-radical by the antioxidant. Rate constants of this interaction have been calculated. Human plasma antioxidants also react with electrochemically generated superoxide anion-radical. A voltammetric method is proposed for estimation of the total antioxidant capacity (TAC) of plasma on the basis of on this reaction. The TAC of plasma was also determined using constant-current coulometry with electrogenerated bromine as the active species. A correlation was observed between TAC data obtained by voltammetry (O•- 2 , in α-tocopherol units) and coulometry (Br2 as titrant). TAC of plasma from patients with purulent infections was determined. Statistically significant differences were found between TAC of patients and control group. Treatment of purulent infections increases the TAC of plasma. So, use of electrochemical methods (voltammetry and coulometry) for determination of TAC can be used for estimation of the effectiveness of treatment. © Springer-Verlag 2005.

http://dx.doi.org/10.1007/s00216-005-3132-5

Keywords

Plasma, Superoxide anion-radical, Total antioxidant capacity, Voltammetry